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# DEVELOPING SOURCES AND TECHNIQUES FOR ALTERNATIVE FINANCING OF ENERGY CONSERVATION PROJECTS FOR LOCAL GOVERNMENT

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CITY OF HOUSTON
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# PREFACE

The Urban Consortium for Technology Initiatives was formed to pursue technological solutions to pressing urban problems. The Urban Consortium conducts its work program under the guidance of Task Forces structured according to the functions and concerns of local governments. The Energy Task Force, with a membership of municipal managers and technical professionals from eighteen Consortium jurisdictions, has sponsored sixty-eight energy management and technology projects in 30 Consortium member cities and counties since 1978.

To develop in-house energy expertise, individual projects sponsored by the Task Force are managed and conducted by the staff of participating city and county governments. Projects with similar subjects are organized into "Units" of four to six projects each, with each Unit managed by a selected Task Force member. A description of the Units and Projects included in the Fourth Year (1982-1983) Energy Task Force Program follows:

**UNIT -- MUNICIPAL FINANCIAL MECHANISMS**

Designed to develop and apply innovative local financial management systems for municipal energy programs, projects focused on both capital and noncapital expenditures for energy management and the inclusion of these procedures into the normal budgeting practices of local governments. The Unit consisted of six projects:

- Cleveland, Ohio - "The Energy Savings Payback Fund (ESPF): A Municipally Financed Shared Savings Program"
- Dade County, Florida - "Energy Financing For Local Governments: Metropolitan Dade County's Energy Investment Fund"
- Houston, Texas - "Alternative Sources and Techniques for Financing Local Government Energy Conservation Projects"
- New Orleans, Louisiana - "An Innovative Financing and Incentive Package to Reduce Municipal Energy Consumption"
- Pittsburgh, Pennsylvania - "Improving Energy Management and Accountability in Municipal Operations: A Model Budget for Local Governments"
- Public Technology, Inc. - "Financing Energy Efficiency: Options and Decisions in Five Local Governments"

**UNIT -- PUBLIC/PRIVATE COORDINATION**

Designed to define effective strategies to increase private sector participation and financial investment for energy management and energy related business development in urban areas, projects focused on means to improve private/public collaboration in energy efficient land development, for industrial and business expansion and for participation with energy utilities. The Unit consisted of five projects:

- Detroit, Michigan - "Rehabilitation of Older Housing to Superinsulated Standards: Energy and Air Quality Impacts"
- Indianapolis, Indiana - "Financial Options for the Construction of Fluidized Bed Combustion Systems"
- Kansas City, Missouri - "Development of an Energy Park in Kansas City: Issues and Implementation Options"

- Memphis, Tennessee - "Memphis Area Rideshare On-Line Information System"

- Washington, DC - "Service and Conservation Alternatives to Increased Electricity Generation"

UNIT -- INNOVATIVE ENERGY TECHNOLOGIES

Designed to develop and apply new energy technologies not previously proven for use in local governments, projects covered a variety of topics ranging from the use of municipal wastes as alternate energy resources to innovative applications of telecommunications technology for energy management. The Unit consisted of five projects:

- Baltimore, Maryland - "A Hydrate Process for Dewatering Sewage Sludge: Feasibility and Energy Resource Potential"

- Columbus, Ohio - "Planning for Telecommunications in a Local Government: Issues, Strategies and Energy Management Aspects"

- Denver, Colorado - "Alternative Uses for Digester Methane Gas: An Analysis of Technical and Economic Feasibility"

- Phoenix, Arizona - "Energy Conservation through Computerized Automation of a Wastewater Treatment Plant"

- San Antonio, Texas - "Landfill Gas Recovery: A Methodology for Site Planning"

UNIT -- INTEGRATED ENERGY SYSTEMS

Designed to identify procedures to resolve difficulties inherent in the implemention of integrated energy systems, projects addressed initial feasibility studies, technology assessments and analyses of institutional or financial barriers. The Unit consisted of four projects:

- Chicago, Illinois - "An Initial Assessment of District Heating and Cooling: A General Methodology Applied in Chicago"

- Hennepin County, Minnesota - "Multi-jurisdictional Planning for District Heating: A Concept Plan for Bloomington and Hennepin County, Minnesota"

- New York, New York - "Financial Planning for District Heating: The Brooklyn Navy Yard Project"

- San Francisco, California - "Renovation Opportunities for a Steam District Heating System: A Decision Process in San Francisco"

Reports from each of these projects are specifically designed to aid the transfer of proven experience to other local governments. Readers interested in obtaining any of these reports or further information about the Energy Task Force and the Urban Consortium should contact:

Energy Program
Public Technology, Inc.
1301 Pennsylvania Avenue, NW
Washington, DC 20004

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# CHAPTER 1 -- OVERVIEW

## ABSTRACT

Identifying financing sources to pay for energy conservation projects is the greatest potential obstacle to implementing energy conservation measures in private and public sector facilities. Local jurisdictions that want to take advantage of energy conservation opportunities often do not have the in-house expertise to determine which financing techniques are available or how to evaluate and pursue those that exist.

Many companies have demonstrated reduced energy cost of over 50% with investments of $10,000 to $50,000. Many other companies and local jurisdictions would like to achieve such results but they do not have the in-house capital to commit to defray any capital intensive cost for energy improvements of their facilities.

This research project was designed to provide some potential guidelines which could be used by local jurisdictions in identifying various financing mechanisms and determining which financing mechanisms best fit a given type of energy conservation project.

The private sector has addressed their financing problems through innovative financing approaches such as syndication/investment, leasing and shared savings. The public sector has addressed their financing problems through existing financing mechanisms such as operating funds, tax-exempt municipal lease purchase, general obligation bond funds, and certificates of obligation. Many of the private sector's innovative financing approaches are available to local jurisdictions but few have information on how and when to use these financing mechanisms. These, and other innovative and traditional financing sources, were identified and researched through this project.

Although most of the information gathered for this project is specific for Houston, the information researched can serve as a basis for investigation for other jurisdictions and can serve as a foundation of information from which to build.

There were four areas of emphasis researched and analyzed during this project:

- Identification of various existing and innovative financial mechanisms that were applicable to municipal governments;

- Applicability of the various existing and innovative financial mechanisms to specific energy conservation projects;
- Analysis of the economic, institutional, legal, and political constraints of the identified financing mechanisms; and
- Development of a selection criteria to assist jurisdictions in making energy management decisions based on the economic, institutional, legal, and political constraints of local, state, and federal government.

Based on the economic analysis, the results of this research project indicated that municipalities have both traditional and innovative financial mechanisms available to them. The results further indicated that operating and/or capital bond funds are, generally, the most <u>cost effective</u> financing mechanisms, but other financing mechanisms are more advantageous because of the lack of institutional, legal and political constraints.

PROJECT PURPOSE

The purposes of this research project were to identify existing and innovative sources and techniques for financing energy conservation projects; evaluate the economic, institutional, legal, and political constraints to utilizing various financing mechanisms and to develop a selection process to assist jurisdictions in determining which types of financing mechanisms best fit certain types of energy conservation projects. The financing mechanisms researched, initially, focused on the use of existing or conventional types of financing. Those financing mechanisms considered conventional were: bank loans, certificates of obligation, extended payment plans, general obligation bond funds, operating funds, revenue funds, and leasing (conditional and true). Those financing mechanisms considered innovative were: chauffage, economic development, investments, shared savings, syndications, leasing/tax-exempt municipal lease purchase and utility assisted. State and local laws are significantly different as to the ways municipalities can finance energy projects using tax dollars. Therefore, interpretation of state and local laws must be researched on an individual city and state basis.

This project also attempted to define which financing mechanisms are most appropriate for certain sizes of energy conservation projects and to highlight some of the institutional, legal, and political constraints which might prohibit their use in local jurisdictions based on the research completed by Houston. Further research will be required by municipalities to determine whether or not certain types of financing mechanisms could be utilized legally within the constraints of their governmental structures and state laws.

## REPORT ORGANIZATION

In this report, a general description of the financing mechanisms researched is provided along with a comprehensive analysis of how and when they work and the strengths and weaknesses of each financing mechanism from the perspective of the municipality. The remainder of this report is organized in the following chapters.

Chapter 2 -- Review of Alternative Financing Mechanisms describes each of the financing mechanisms researched and details the specific advantages and disadvantages of each financing mechanism.

Chapter 3 -- Applicability of Financing Alternatives to Local Government Energy Projects describes a case study of financing options for specific energy conservation measures in Houston's City Hall Annex and the workshop conducted in Houston to discuss seven of the major financing mechanisms. This workshop included such financing techniques as tax-exempt financing, economic development financing, utility financing, syndication/investment financing, leasing financing, shared savings financing and tax-exempt leasing financing. Participating financial experts included representatives from such financing institutions as: First Southwest Company, Baltimore Economic Development Corporation, Pacific Gas & Electric, Dean Witter Reynolds, Inc., TXL Corporation, Scallop Thermal Management, First Continental Leasing, and Lane and Edson, P.C. The chapter details which financing techniques are best suited for the specific energy conservation measures in the case study.

Chapter 4 -- Evaluating the Cost of Alternative Financing describes the "Energy Life Cycle Cost" Program developed by Public Technology, Inc. The life cycle cost program developed is applied to the Houston Case Study and demonstrates the economics of using several of the financing mechanisms researched during this project.

Chapter 5 -- A Comparative Framework and Suggestions for Application describes the comparative analysis, the case study, and the energy life cycle cost analysis. This final chapter also provides the reader with the lessons learned by the City of Houston through its conduct of this project. Finally, this chapter attempts to explain how to best utilize the information presented in this report.

# CHAPTER 2 -- REVIEW OF ALTERNATIVE FINANCING MECHANISMS

## INTRODUCTION

Over the past several years, local governments have conducted thousands of energy audits of their municipal buildings. They have worked to identify the most cost effective conservation opportunities, to organize internal energy management committees and to implement as many "low cost" energy conservation recommendations as feasible. This has been a successful effort. However, further improvements which could have much greater energy conserving impact have been halted due to lack of financing capital.

At a time when local jurisdictions have required significant capital investment in order to realize additional cost reductions, funds have been limited. Most jurisdictions have been quite successful in implementing "low-cost" or "no-cost" improvements. But when significant capital investments are required they have often been unable to convince top administrators to make significant capital funding commitments, even for projects with paybacks of a few years or less.

Many jurisdictions have files filled with proposals for cost effective energy improvements just laying dormant. This research project was conducted to identify mechanisms to finance those costly, but cost effective, improvements without diverting any of those much needed local funds from other competing local services such as police protection, fire protection and street improvements or leveraging those limited funds in order to finance energy projects. There are dozens of financing mechanisms which a jurisdiction can utilize to finance energy improvements. This research project looked at fourteen (14) mechanisms which can be categorized into five basic areas as listed below:

Bank Financing
- loans
- extended payments

Local Government Financing
- operating funds
- bonds/general obligation
- revenue bond funds
- certificates of obligation

Leasing Financing
- true
- conditional sale lease
- tax-exempt municipal lease purchase

Shared Savings Financing
- conventional shared savings
- chauffage
- syndication/investment

Subsidized Financing
- economic development
- utility assisted

These mechanisms and general observations about them are described in the remainder of this chapter.

## DESCRIPTION OF FINANCING MECHANISMS

### 1. BANK FINANCING

#### Loans

Conventional bank loans can legally be made to cities. Bank loans are available from commercial banks, savings and loans, credit unions and mutual savings associations. Most of these institutions have funds that could be made available to finance energy conservation projects.

#### Extended Payment Plans

Extended payment plans are made available through vendors and contractors and are similar to bank loans except the interest rates are higher and the vendor or contractor usually selects the lending agency, since they will probably guarantee the repayment of the loan. The savings is usually guaranteed or insured by the vendor or contractor to eliminate risk.

#### Observations

Several municipalities have been creative in their use of bank loans as a financing mechanism to improve the energy efficiency of their facilities. For example, Holyoke, Massachusetts is using a $150,000 grant from the Housing and Urban Development (HUD) Administration to use as leverage with nine local banks who have committed $1,272,000 in local funds to finance energy conservation loans. Loans will be made for projects with a payback of five years or less.

Funds will be drawn down in the ratio of $2.50 of private funds for each $1 of HUD funds.

There is a risk that loans made from banks based solely on projected energy savings may not be wise. The energy conservation measures may not actually reduce the cost adequately to repay the loan. Loans are normally not given specifically on the basis of planned energy improvements because the collateral value of such improvements is very small. For example, if a $50,000 loan is needed to finance a sophisticated energy management system, the value of the actual equipment would be only a fraction of this cost, with most of the loan required for design and installation costs. In addition, the potential cost for the bank to repossess the equipment would be extremely high. Another problem is that banks prefer to use relatively short terms. Thus, a project that pays for itself in four years but is financed over two years means that at least half of the payments need to be taken, not out of the energy savings, but out of other budgets.

Bank financing has not been used extensively for energy conservation measures because of its short term and high cost (compared to other financing options) and because of the lack of acceptable collateral from the financing institutions' perspectives. In addition, bank financing is highly dependent on the borrower's credit rating and is better suited for large, simple energy conservation measures rather than multiple, complex measures.

The most important factor which will influence the availability of bank financing is market conditions. In the future, as energy savings are more widely accepted as being accurate projections, banks may become more interested in making loans based on collateral of the energy equipment.

## 2. LOCAL GOVERNMENT FINANCING

### Operating Funds

Operating Funds are collected through taxes, fees, and any other assessments placed upon the public. These funds are used to pay for day-to-day local government operations and are allocated on a yearly basis. These funds are often used for equipment purchases which typically cost less than $5,000 and for recurrent multiple equipment purchases such as vehicles.

### Bonds (General Obligation)

General Obligation bonds are issued and sold to investors with the municipality guaranteeing the payment of principal and interest from tax and other revenue funds. The bonds are secured by an unconditional pledge of the issuing government to levy unlimited taxes to retire the bond. The interest rates are much lower than other types of financing because the income the investor receives, in the form of interest payments, is not taxable to the investor. The funds are usually for large, long term capital expenditures, such as building new buildings and streets and upgrading existing facilities.

Revenue Bond Funds

Revenue Bond Funds are designed to provide front-end financing for facilities that can pay for themselves over the investment's useful life from project revenues. The principal and interest on the bonds are payable from the earnings of an enterprise such as water or sewerage systems. No taxes are levied or pledged as a back-up, but legal authorization is required to establish the revenue source. The most common type of revenue bond funds currently used are Industrial Development Bonds (IDBs).

Certificates of Obligation

City governments can still take advantage of interest rates which are almost as low as those for bonds through Certificates of Obligation (COs) where these instruments are allowed by law. They are issued by the municipality and purchased by banks or other financial institutions. The principal and interest is normally paid using operating funds. The Certificate of Obligation is usually for a specific capital improvement project and requires only the approval of City Council or Board of Supervisors. The cost of issuance is much lower than that of bonds because a vote by the public is not necessary and the legal and financial preparation is minimal.

Observations

There are several observations which are essential to the effective utilization of local government financing for energy conservation measures. The competition for always scarce operating funds is intense, and seldom will any energy conservation measures except low-cost or no-cost measures be successful when compared to the need for more police or better streets. Further, any energy conservation measure which will not pay for itself in one year is likely to not receive funding through operating funds.

General obligation (G.O.) bonds must be approved by the voters, and usually there is a limit on the amount of G.O. bonds which can be issued. G.O. bonds are traditionally used for one-time, permanent improvements with useful lifetimes of fifteen to thirty years. Given the widespread voter resistance to additional taxes, it is difficult to obtain approval for any but the largest and longest-lived energy conservation measures.

The competition for these long-term, tax-supported items is as intense as the competition for operating funds. Energy measures usually cannot successfully compete with the public needs for bridges, treatment plants, or libraries. However, often times energy conservation concerns can be addressed in the other approved capital improvements. For example, both Houston and New Orleans use energy efficiency criteria in selecting capital improvements to be funded by G.O. bonds, but very few exclusively energy efficiency improvements are approved using these funds.

Frequently large energy conservation projects have their own revenue stream which can be used as the basis of revenue bonds. Revenue bonds do not require voter approval, but their success is highly dependent on the realism of the projected revenue stream, and the associated credit rating assigned. Waste to energy and cogeneration facilities are often financed with revenue bonds or a combination of financing techniques including revenue bond financing. Revenue bond financing is generally not useful for small cost items. It cannot be used for energy measures which cannot document a realistic revenue from the proceeds of the sale.

There are state laws and city charter restrictions which may prohibit the use of certificates of obligation. Several states lack legal authority to use certificates of obligation. Many jurisdictions refuse to use certificate programs even though they have statutory authority for political or other reasons. Another obstacle is the budgeting process which may prevent the obligation of funds for payment of the certificates.

A further problem with local government financing mechanisms is the length of time it takes to get an energy project started. Most energy conservation projects have to be approved by the municipal government body. Job performance specifications, competitive bids, and purchase orders for a contract must be resolved prior to allowing the contractors or vendors to start work.

In summary, "low cost" energy projects with short term paybacks are usually funded successfully with local government funds and would include such retrofit items as caulking, weatherstripping, and the installation of time clocks. More costly items and installation costs would require funding from other financing sources. These high cost items face competition from other municipal needs and are generally unsuccessful in that competition. Some large scale, revenue providing energy measures can use revenue bond financing. Certificates of Obligation can be used in some instances, but they have legal and procedural limitations which must be overcome for them to be used.

## 3. <u>LEASING</u>

### <u>True Lease</u>

Leasing is an attractive means of financing equipment and improvements in the private sector; its attractiveness in the public sector is less clear from an economic perspective. By leasing a municipality makes periodic payments for the use of the energy equipment. Usually, the lease term is less than or equal to the equipment's useful life. In a true lease, the lessee does not own the equipment at the end of the lease period. At the end of the lease, the lessee can (1) renew the lease for an agreed upon term, (2) buy the equipment for its value at the end of the lease or (3) acquire other equipment.

In a true lease, the lessor retains ownership and can depreciate the equipment included in the lease. Generally, he cannot take investment credits. Sale of the equipment to the lessee can be negotiated at the end of the lease, but no pre-set value is allowed.

## Conditional Sale Lease Purchase

A lease purchase arrangement allows for equity accumulation through rental payments. With this type of leasing arrangement, the municipality is essentially buying on credit except the interest portion of the payment made by the municipality is tax free to the lessor. An asset is purchased on an installment basis, the terms of the lease are matched with the project's useful life, and the risk in long-term borrowing for a short-term project is avoided. A legal consideration is the Fiscal Funding Clause which stipulates that the lease is not automatically renewed; it is made conditional on full payment in the next fiscal period.

Voter approval is not required and lease payments are not restricted to debt ceilings.

Tax-exempt Municipal Lease Purchase

The Tax-Exempt Municipal Lease-Purchase is one that can be used only by tax-exempt entities such as municipalities. Tax-exempt financing normally involves the issuance by a state or local government of tax-exempt bonds. What makes it attractive to the lessor is that the interest portion of the lease payment is tax-free income to the lessor. The interest rates are generally comparable to that of municipal bonds and certificates of obligation and, therefore, it is an attractive financing source.

Observations

Several municipalities are seeking to solve their financing problems by leasing energy equipment. This financing mechanism offers the municipality, which has limited operating capital, a less expensive monthly expenditure of funds. It also provides the municipality with the ability to use new technologies without purchasing the equipment and risking the chance that the equipment does not do what is is supposed to do. If at the end of the lease period, the municipality is not satisfied with the equipment, they can return the equipment.

Leasing allows the municipality to avoid long term commitments of operating funds. Lease arrangements are generally made so that the payments can be offset by the savings in the energy costs. However, the concept of leasing energy equipment is an unfamiliar one to municipalities. This obstacle is probably more restrictive than some of the other disadvantages such as the lack of equity build up and the assuming of equipment maintenance and insurance. The publication, Creative Capital Financing for State and Local Governments[1], contains an extensive chapter on leasing which should provide further assistance to local governmental energy officials interested in this financing mechanism. The municipality which decides to lease must be aware that the leasing company will make every effort to structure the lease contract to take full advantage of the available tax benefits.

Tax-exempt municipal lease purchase financing is a type of conditional sale lease and is not new; however, it is gaining increasing attention. This type of financing has been used for a wide range of equipment used by governmental units including vehicles, computers and medical equipment but to a lesser extent in the acquisition of buildings, other real property, and for energy equipment. Transactions using this financing mechanism range from $10,000 to more than $23

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[1] The publication can be ordered from: Municipal Finance Officers Association of the United States and Canada, 180 North Michigan Avenue, Suite 800, Chicago, Illinois 60601

million over a contract term. It is expected that as economic conditions for governments change, it will grow as it becomes more widely known and appreciated as an alternative financing mechanism. The major b n o x-exempt lease financing is that this type of financing permits the governmental unit to finance the acquisition of essential capital items without incurring debt limitations or costly and cumbersome debt incurrence procedures such as voter referendums. The governmental unit also benefits from the tax-exempt status of interest on the lease purchase obligation.

The major advantage to any type of leasing arrangement is that the private sector is employed directly as a source of funds. Another advantage is the variety of energy measures which can be financed. When a project is too large to finance out of current revenue or too small to justify a bond issue, the municipality can use leasing to finance the energy project.

Finally, the municipality avoids large one time capital expenditure appropriations by paying over the useful life of the equipment and the municipality can budget its cash flow for more immediate needs.

## 4. SHARED SAVINGS

### Conventional Shared Savings

Shared Savings programs involve an energy service company, engineering company, energy equipment firm, or similar company, which will conduct an energy audit to determine the current energy consumption and potential energy savings. The company will enter into a contract to retrofit the facility at no initial capital cost to the user. The company acquires and installs the measures at its own expense, with its costs reimbursed through an agreed portion of energy savings that result from the equipment it has installed. Most shared savings agreements continue this "sharing" of savings over a period of several years.

The company usually also agrees to maintain and repair the equipment and measure the energy consumption in the buildings. The customer is not required to make any fixed payment to the company for service or maintenance of the system, or for any of the other services. The company uses the energy audit to establish a base energy use for the building. That base line will be the standard used to measure future energy savings. Once the equipment is installed, the company will commonly conduct monthly audits to measure the savings and monitor the building's energy efficiency equipment. The building owner usually pays the monthly utility bills, while sending a copy of the bill to the company for the savings and remits the dollar amount of the agreed upon share of savings to the company.

Chauffage

Chauffage is a variation of a shared savings plan. Chauffage is a French term and is used when a firm is contracted to furnish all energy to a facility-electricity, natural gas, coal, fuel oil, and solar. The firm can also implement energy conservation measures and share in the savings. (No municipalities within the United States were identified which have used this type of financing mechanism.)

Syndication/Investment

Syndication is a type of shared savings arrangement which is financed by a "syndicate" of investors. The syndicator locates a facility which fits the criteria developed. The syndicator hires a professional engineer to determine whether the facility will produce sufficient savings to be an attractive investment. Assuming the building appears to be an acceptable investment opportunity, a professional engineer is retained to design and recommend the specific energy efficiency equipment for the facility. The engineer also supervises the installation and is paid a percentage of the total contract fee.

Individual or corporate investors contribute capital to a syndication organized to purchase, install and maintain the energy efficiency equipment. In some transactions the syndication purchases the equipment from the manufacturer, or from a middleman who buys it from the manufacturer and sells it to the syndication at an inflated "retail" price. The syndication then "leases" the equipment to another firm which arranges to install the equipment in the user's building. The firm which actually contracts with the end user may technically only "lease" the equipment from the syndication. In other transactions the syndication has a direct contract with the user of the equipment.

Observations

More and more municipalities are being approached by companies offering to install energy saving equipment in their facilities, improve the operation and maintenance procedures of those facilities and reduce the energy cost of those facilities without requiring any up front capital expenditures by the municipality. In payment for these services, the company is compensated by spliting the energy cost savings resulting from their services with the municipality.

There are two common types of shared savings arrangements. The first type savings based agreement is an energy management system agreement. In this type of arrangement the company uses computerized control systems to manage the use of energy in a building. The energy service company finances the cost of the energy management equipment as well as operates the equipment. In return for these services, the energy service company is paid a fixed fee or a share of the energy savings. There are at least 250 energy service companies using this form of service agreement. The energy service company guarantees to lower utility bills of the facilities which they manage.

The other type of agreement is the full service agreement. This is a very comprehensive agreement. The company will take over all the energy-related functions of a building and the company is paid a fee or will share in the costs savings. The company guarantees to lower the energy bills of the facilities in which they manage. In some instances, the company will take on the responsibility for paying the utility bill and will make any energy-related capital investments it determines are economically feasible in order to lower the energy usage of the building and increase the energy cost savings. There were only a few companies which provided this type of service.

Any financing technique which offers such variety in services is apt to have both negative and positive aspects. Such is the case for shared savings. While this financing technique requires little or no investment on the part of the municipality, this financing technique may not be the most cost effective method of saving energy. Additionally, while reductions in energy utility bills is generally guaranteed, a shared savings arrangement may discourage or prohibit other energy investments in a given facility that are not implemented by the shared savings company. It is likely to take many months to get the initial shared savings contract approved.

The municipality must take certain safeguards to insure that a shared savings agreement does not limit the operating procedures or levels of building usage. Since any energy service company agreement is for an extended time period, the municipality must find out if they can legally enter into multi-year contracts.

Finally the shared savings agreement has to be entered into with an understanding and agreement as to the methods used to normalize energy consumption figures as well as the methods of predicting future energy prices and usage. Many municipalities have become interested in this financing mechanism, however, the institutional, legal, and political constraints have slowed the implementation process. Syndication/Investment financing has the same benefits and disadvantages of conventional shared savings agreements.

Another type of shared savings financing is chauffage. The greatest advantage of a chauffage financing plan is the ease of funding. The utility accounts can be encumbered up to the maximum amount that the company estimates that energy costs will be and payment for utility cost will be to the chauffage firm rather than to the utility company. The contract would be for the estimated cost of utilities for the five to seven year term and any savings in utility costs will simply be placed in a surplus account at the end of each fiscal year. The simplicity of this type of financing will probably make it a most appealing financing mechanism. However, we could not identify any municipality which has used this type of financing.

The net savings to a city in a shared savings agreement would certainly not be as great as installing the same equipment using bond or operating funds, if both were equally likely occurrences. A private firm must have a reasonable return on its investment to cover its cost and profit which are additional costs in excess of those which a City would incur using bond or operating funds. However, the savings often times will be realized with shared savings agreements much sooner than the other techniques. The distinct advantage of shared savings financing is that energy conservation measures are not competing for scarce operating or bond funds and that jurisdictions are using private sector investment funding for front end cost and not their own resources.

## 5. SUBSIDIZED FINANCING

### Economic Development

Economic Development financing is usually used by a municipality to stimulate business investments and create jobs. Most local governments have developed, over the years, a series of effective programs to retain and attract business investment by improving the ability of individual firms to produce goods and services less expensively in their locality than in other comparable areas. Early programs for economic development, as well as current programs, were built on assumptions that business location decisions were, generally, predicated on what a city could offer, that the primary offer should be cost reduction through tax incentives and regulatory relief and that bigger businesses were more desirable since they created more jobs. Municipal managers are now beginning to find creative ways to use economic development funds to link with private funds to provide new opportunities for growth and decrease the long term negative effects of increased energy prices. Some economic development funded programs are: Community Development Block Grants, U.S. Department of Housing and Urban Development (HUD) 108 and Urban Development Action Grants.

The Community Development Block Grant Program is a federally funded entitlement program whereby funds can be used for such things as developing infrastructures in cities, developing industrial parks and business development. The HUD 108 Program is collateralized by the Community Development Block Grant Program and is a mortgage and rental subsidy program. The Urban Development Action Grant Program (UDAG) is geared toward leveraging of private investments.

There are Housing and Urban Development energy conservation initiatives that apply to new construction and rehabilitation.

Utility Assisted

Utility financing is any financial arrangement in which a utility is involved, either as an originator of the financing, a participant in servicing or marketing the financing, or as a guarantor or subsidizer of financing. Utility assisted financing includes loans, rebates, lease financing and utility operated energy services companies. Financing programs under this category are being initated by both investor-owned utilities and public-owned utilities, but are usually targeted to their residential consumers. Assistance to the industrial and commercial sectors has been limited in the past but is gaining considerable momentum recently.

Observations

There are still a few federally sponsored programs which provide funding for energy conservation projects. These programs have traditionally been used to finance small business and residential type energy projects.

At the local level, three counties in the Southern Tier Central Region of New York have formed a regional energy development corporation to make loans to foster energy conservation activities in the three county area. Loans are made available from a $200,000 fund provided by the Appalachian Regional Commission. The Chautauqua County (New York) Industrial Development Agency started a revolving loan fund to make low interest loans for energy efficiency improvements. They received a $250,000 grant from the Appalachian Regional Commission.

Another example of economic development financing is the Small Business Administration which has a small business energy loan program established as Section 7 (l) under the Small Business Act. Loans are available to assist small businesses establish or expand energy related activities. Over 400 loans have been made under this program.

In addition, the State Assistance Fund for Energy, California Business and Industrial Development Corporation ("SAFECBIDCO"), provides loans to small businesses to finance alternative energy projects or energy efficiency improvements.

With respect to utility assisted financing, there are few utilities that provide direct financial assistance to customers. Pacific Gas and Electric is one such investor-owned utility. Municipalities in the Tennesse Valley area are one of the few which have the advantage of having a utility which provides direct financing of energy conservation projects. The Tennessee Valley Authority's loan program provides energy audits and low cost financing for energy projects to its residential customers. This program was initiated in January of 1979 and was intended to benefit TVA by reducing peak power requirements and delay the need for future generating capacity. The loans which range from $1,000 to $100,000 must be used to fund the installation of energy conservation measures recommended by the TVA energy audit. The installed measures which will be considered for financing must have a one-to-ten year payback and are financed at an interest rate of 14%. (This program began with an 11% interest rate). Because there is still skepticism as to whether energy conservation is effective, TVA's initial project resulted in only 58 loans being closed for a total of $607,000. With increased awareness during 1982, TVA financed over $2.0 million worth of loans.

While the statistics speak for themselves, many utilities are reluctant to become active in sponsoring energy conservation loan programs. Some of the reasons for this reluctance are: management's belief that utilities should not become involved with financing but should leave financing to banks and other financial institutions which have more expertise; management's concern that any entry into financing might lead to charges of unfair competition with traditional activities of banks, savings and loans institutions and other financial institutions. Finally, many utilities have not involved themselves in financing because they do not have the capital to finance such efforts.

FINANCING MECHANISMS

| | |
|---|---|
| Bank Financing | . Commercial Loans<br>. Extended Payment Plan |
| Local Gov't Financing | . Bonds (General Obligation)<br>. Operating Fund<br>. Revenue Bonds<br>. Certificates of Obligation |
| Lease Financing | . True<br>. Conditional Sale Lease<br>. Tax-Exempt |
| Shared Savings Financing | . Conventional Shared Savings<br>. Chauffage<br>. Syndication Investment |
| Subsidized Financing | . Economic Development<br>. Utility Assisted |

CONCLUSIONS

Fourteen types of financing mechanisms for energy conservation measures have been identified and investigated, as summarized in this chapter. The financing options range from the traditional operating and bond fund alternatives to the more innovative tax-exempt lease purchase and shared savings approaches.

Each financing mechanism has strengths and weaknesses with respect to financing energy conservation measures as previously detailed. Some financing mechanisms can be widely used; others lend themselves to specific types of energy projects.

General observations have been presented with respect to the particular merits, benefits, limitations, and use of the various financing mechanisms. This chapter has examined each of these financing techniques separately. In the next chapter a case study will be used to further investigate selected financing alternatives.

Then, a comparative analysis will be completed indicating the strengths and weaknesses of these financing techniques for various energy measures. This comparative analysis can be used as a general guide for selecting financing packages for energy improvements in a public sector environment.

# CHAPTER 3 -- APPLICABILITY OF FINANCING ALTERNATIVES TO LOCAL GOVERNMENT ENERGY PROJECTS

## INTRODUCTION

The project of developing sources and techniques for alternative financing of energy conservation projects for local governments was divided into two major emphasis areas. The first emphasis area focused on expanding the definitions of all the financing mechanisms and detailing how they had been used in the public and private sectors. The work for this effort was conducted by independent research. The second area of emphasis was to develop a real world case study of public sector energy conservation measures which require financing and to use the case study to assist in developing a comparative guideline for the various financing options. This effort was aided by the conduct of a half-day workshop which addressed these mechanisms. The following discussions and abstracts of presentations are the results of the real world application of alternative financing mechanisms to specific energy improvements which are typical of those found in local government facilities.

HOUSTON CASE STUDY

A case study was developed using the City of Houston's City Hall Annex to further investigate the relative utility of various financing mechanisms.

In general, the City developed its case study to focus more specifically on those financing mechanisms which could be used to finance "significant cost" energy conservation projects such as: retrofit of motors, replacement of chillers, installation of energy management systems, and changing out of incandescent lamps to fluorescent lamps.

Seven energy conservation measures were identified for financial analysis with costs ranging from $5,632 to $116,800 with a total cost for all seven measures of $304,978. The Exhibit on the following page summarizes the seven measures and the other relevant information provided to the financial experts. A detailed analysis of the case study and its assumptions is presented in Appendix A.

Based on the characteristics of the seven individual energy conservation measures and the total package, it was decided not to investigate operating funds or bank financing. To test the feasibility of using the financing mechanisms which are innovative, the City of Houston sponsored a half day workshop which addressed seven (7) financing mechanisms in the following areas, with the specified financial experts.

ENERGY CONSERVATION MEASURES FOR CITY HALL ANNEX - CITY OF HOUSTON
Prepared By Phillips S. Baker, P.E.
Deputy Energy Official

| | | | SAVINGS | | | |
|---|---|---|---|---|---|---|
| | | INSTALLATION COSTS | $/YR | PAYBACK-YR | KWH/MCF YR | A/C TONS |
| 1. | Dimmers | $60,000 | $24,963 | 2.4 | 357,000 | 28.2 |
| 2. | Interior Cans to 22 W Fluor | 16,588 | 24,321 | .68 | 347,400 | 27.4 |
| 3. | Exterior Cans to 22 W Fluor | 5,632 | 6,888 | .81 | 98,400 | -0- |
| 4. | Garage Lighting | 20,000 | 8,891 | 2.25 | 127,020 | -0- |
| 5. | Retrofit - High Eff Motors | 21,958 | 6,325 | 3.47 | 90,357 | -0- |
| 6. | Replace Chillers 2-320 tons @ 416 A | 115,200 | 30,600 | 3.75 | 438,000 | -0- |
| 7. | EMS to Include VP Grade Controls & Balancing System | 100,000 | 51,450 (El)<br>9,542 (NG) | 1.63 | 735,000 (El)<br>1,704 (NG) | |
| | | $339,378 | $163,040 | 2.08 | 2,193,176 (El)<br>1,704 (NG) | 55.6 |

REDUCTIONS
KWH (Elec) = 2,193,176 :6,800,000 = 32,25%
MCF (NG) = 1704 ÷ 4000 = 42.6%

ASSUMPTIONS

1. A/C and Interior Lighting Operate 3600 Hrs/Yr
2. Exterior Lights Operate 3000 Hrs/Yr
3. Garage Lights and Fans Operate 8760 Hrs/Yr
4. Total Elec Pwr For Bldg = 6,800,000 KWH/YR = $476,000/Yr (w/o ECM)
5. Total MCF For Bldg = 4000 MCF/YR = $22,400 (w/o ECM)
6. Water Chillers Operate At Full Load Equivalent To 3000 Hrs

- Local Government Financing
  - General obligation bonds (First Southwest)
- Leasing Financing
  - True (TXL Corporation)
  - Tax-exempt lease purchase (First Continental)
- Shared Savings Financing
  - Conventional (Scallop)
  - Syndication/Investment (Dean Witter Reynolds)
- Subsidized Financing
  - Economic Development (Baltimore Economic Development Corporation)
  - Utility assisted (Pacific Gas & Electric)

The workshop brought together public and private sector speakers and participants from Texas, Pennsylvania, Florida, Louisiana, the District of Columbia, California, Maryland, New York and Ohio. The program for the workshop is described in Appendix B.

The workshop addressed which individual or combinations of financing mechanisms could be utilized to finance the seven projects in the case study. It provided a forum to address how the financing mechanisms listed above could be applied to specific energy conservation measures in the City Hall Annex Building, as identified by financial experts for each financing technique.

A summary of each speaker's recommendations as to the feasibility of using their discussed financing mechanism follows:

## TAX-EXEMPT FINANCING

### Jim Kerley-Executive Vice President-First Southwest Company

With respect to the specific energy conservation measures identified in the City Hall Annex Case Study, the traditional financing techniques, general obligation bonds, revenue bonds, industrial development bonds, and certificates of participation are not suitable because of the small size of the required investment. Normally, standard bond issues are uneconomical below $400,000 because of legal fees, printing cost, registration cost, and other associated expenses. First Southwest suggested that perhaps the City Hall Annex energy improvements could be financed with the following traditional financing technique. A small bond issue could be privately placed with a maturity of 3 or 4 years, and the savings could repay the investment within a short time span. The details would have to be worked out among the participating parties.

## ECONOMIC DEVELOPMENT FINANCING

### David Hash, Sr.-Vice President-Baltimore Economic Development Corporation

In the City Hall Annex Case Study, the best course of action would be for the City to sell the building (at an estimated price of $17.6 million) to private investors and have the City lease back the facility for its useful life, with a buyback provision at the end of a 15 year term. By using this sales buyback technique the tax benefits can be accrued by the private sector while the cash flow benefits would accrue to the City. However, there is federal legislation pending which will make this kind of financing very difficult in the future.

## UTILITY FINANCING

### Michael Mertz-Pacific Gas & Electric

The City of Houston's Case Study was analyzed by the technical staff of Pacific Gas and Electric and several recommendations were made: include the use of gas absorption units instead of chillers, establish a replacement schedule for motor replacement, emphasize task lighting rather than wholesale lighting replacement, question the need for an automated energy management system instead of a manual system. Futhermore, utility financing of energy conservation measures should be primarily used as supplemental funding rather than full funding of such projects.

## SYNDICATIONS/INVESTMENTS FINANCING

### Alfred C. Jones-Vice President-Dean Witter Reynolds, Inc.

In looking at the City Hall Annex Case Study as a project for limited partnership under a syndication/investment financing arrangement, the conclusion is that such financing is not the vehicle for the City's Case Study for the following reasons: the transfer of tax benefits is difficult to structure in a municipal deal, investment tax credits are not available to publicly owned facilities; the depreciation is limited to 15 years; the investors prefer discreet assets, not mixed ownership; the size of the investment is too small; and the asset is too complex and not overly attractive. The bottom line for limited partnership financing is that other investments are usually more attractive than publicly owned energy conservation measures. Unless energy projects are large, simple, and attractive, they will not attract limited partnership investors.

## LEASING ARRANGEMENT FINANCING

George C. Day-Attorney-TXL Corporation

Unfortunately, lease financing has only limited application to the City Hall Annex Case Study since no investment tax credit is allowed on publicly owned facilities. Most of the specific energy conservation measures do not have a long enough life for depreciation and the facility's residual value is limited. Possibly the chillers and the energy management system could be financed by lease arrangement, but the other energy conservation measures identified are not appropriate for lease financing. Even these two possible energy conservation measures would have certain legal ownership problems which would need to be resolved to use lease financing.

## SHARED SAVINGS FINANCING

### Arthur Lennon-Vice President-Scallop Thermal Management

Shared savings is perhaps the most costly way to finance these energy conservation measures, but in the City of Houston's case, if no other funds are available, it may be the most cost effective way to finance the energy conservation measures. Under a shared savings contract, without any cost to the city, the building's lighting and air conditioning systems could be upgraded, the energy management system could be installed, and the utility cost could be reduced. The City could benefit because the building systems would be improved and the operating costs would be less even though the City has not been required to make any capital investment.

## TAX-EXEMPT LEASING FINANCING

### Dick Ronchetti-President-First Continental Leasing Corp.

Under the tax-exempt lease financing alternative, as applied to the case study, Houston has several options:

Option 1-- Keep the present system and pay $505,000 per year.

Option 2-- Pay cash for the retrofit of the systems and save $1,096,000 over a ten year period.

Option 3-- Purchase the energy management system by means of tax-exempt lease purchase whether cash is available or not and save $1,198,000 over a six year period.

Option 4-- Purchase the energy management system by means of tax-exempt lease purchase whether cash is available or not and save $1,240,000 over a ten year period.

Option 5-- Purchase the energy management system by means of tax-exempt lease purchase whether cash is available or not with a four year annual advance contract and save $1,242,000 over the four year period.

Tax-exempt leasing has several benefits for the particular case study because it combines attractive public and private sector financing benefits, flexibility, avoids large capital expenditures by the public entity, and is commonly used by public entities, although not frequently for energy conservation measures.

CONCLUSION

In summary, each of the seven (7) innovative alternative financing techniques discussed: Shared Savings Financing, Leasing Financing, Utility Assisted Financing, Syndication and Investment Financing, Economic Development Financing, and Tax-Exempt Leasing Financing have specific benefits and drawbacks. Four speakers recommended that the City's energy conservation projects be financed by private bonds, sale-buyback, shared savings and tax-exempt lease. Two speakers recommended that the City should not finance their energy projects using syndications, investment or leasing financing mechanisms. The utility speaker suggested that the proposed energy conservation projects be reconsidered to include alternatives which would require more manual operations than automated. However, based on the comments made by the participants, it could be concluded that shared savings or tax-exempt leasing financing techniques are the most appropriate financing techniques to finance the City's specific projects in this case study. This conclusion will be tested using a life cycle cost model in the next chapter.

In this particular case, the economics as well as the lack of many of the institutional, legal, and political constraints make these latter two types of financing mechanisms look very favorable. This conclusion was reinforced based on the actual experience of Kansas City's City Hall and Municipal Courts buildings, where completed shared savings contracts have resulted in completion of energy conservation improvements totaling $84,000, with an annual realized savings of $111,000 in the first year of the contract.

The workshop participants cautioned that it is essential for the municipality to match the proposed energy improvements with the financing technique which best suits the energy conservation measure. They further cautioned that key constraints included the size of the investment, institutional barriers, legal obstacles, and political limitations. Municipal energy managers were also reminded that energy conservation projects must compete against other potential investments for funding. The private sector financing techniques have the advantage of using someone else's money, but the drawback of competing in the highly selective financial market place. The more attractive the energy project investment financing package can be made, the more likely the financing package can be sold.

# CHAPTER 4 -- EVALUATING THE COST OF ALTERNATIVE FINANCING

## INTRODUCTION

In the preceding chapters, the various financing mechanisms were researched as to how the financing mechanisms work along with the general observation regarding their applicability, and a case study to test the usefulness of various financing techniques on specified energy improvements was developed and used in a workshop. In this chapter, a methodology to evaluate the cost of utilizing several of the alterntive financing mechanisms will be examined.

To be useful for local government practitioners, alternative financing mechanisms for energy conservation measures cannot be presented in isolation or separately. It is essential to provide a comparative framework and to assess the various financing techniques using a variety of factors. In the next chapter, a matrix will be examined which will include a variety of factors upon which alternative financing techniques will be evaluated. In this chapter, the cost of alternative financing tools will be analyzed and compared, using a life cycle cost approach.

## THE LIFE CYCLE COST (LCC) APPROACH

Cost, of course, is one of the essential comparative criteria for financing alternatives, but the way in which the subject can be approached depends, to a great extent, on the municipality's attitude and financial position. The cost of using one financing mechanism over another should be evaluated using life-cycle costing techniques which involve accounting for operating and maintenance cost as a significant part of the cost of a project and accounting for the time value of money.

Frequently, however, only the one-time or immediate costs are used as the basis for a decision. Thus, jurisdictions often make good short term cost decisions which are in reality not cost effective in the long term.

In many cases, the operating and maintenance costs represent the most significant part of the total cost of a project. This fact has been highlighted by the recent increases in energy and personnel cost. Therefore, when considering a project, these costs should be identified and evaluated. Because local governments, like other institutions, have to pay to borrow money, the time value of money also becomes very significant when evaluating the economics of various financing mechanisms. In the approach utilized in this research, this factor is accounted for by converting all costs and savings incurred in different years to a common base (present worth value).

## THE ENERGY LCC PROGRAM

Public Technology, Inc.(PTI) developed a microcomputer program which compares life-cycle cost analysis of energy related projects using up to five financing mechanisms at one time. The Energy Life Cycle Cost Program ("Energy LCC" Program) was developed as a tool to compare the cost of implementing energy projects using alternative financing mechanisms against the cost of not implementing those energy projects.

PTI's program enables local government managers to quantitatively assess the economic merits of five types of financing alternatives for an energy project at one time. Their project was also developed to support individual research conducted by staff from five urban governments participating in the "Municipal Financial Mechanisms Unit" of the Urban Consortium Energy Task Force-Fourth Year Program. This analytical tool was used to test the Houston Case Study as the basis for developing comparative cost criteria for various financing mechanisms. This chapter describes the Life Cycle Cost Program and the results of its application to the Houston Case Study.

The Energy Life Cycle Cost Program is designed to be used by persons with no computer training or experience. By using a microcomputer, the analysis becomes immediately available as soon as information on a project is entered into the computer. The LCC approach accounts for operating and maintenance costs as a significant part of the total cost of a project and accounts for the time value of money. The Energy Life Cycle Cost Program is designed for use on an Apple II microcomputer. A unique characteristic of the program is its capability to analyze different financial options for project implementation. Among these are municipal bonds, operating funds, true lease contracts, conditional sale lease contracts and shared savings arrangements. All of these financing mechanisms were researched during the initial phases of the City of Houston's research project but were amplified by the work conducted by PTI. The results of the PTI project showed that, depending on national economic conditions as well as the financial situation of the local government, any one of the five financing options could prove to be economically feasible.

The overall approach of the Energy LCC model used to calculate the total present worth project cost involved five steps:

1. Calculation of the yearly cost for project implementation.
2. Conversion of the yearly cost to "present worth" costs.

3. Summing the "present worth" costs.
4. Opting to choose the "do nothing" alternative by completing steps 1-3.
5. Comparing the present worth costs of the project implementation and do nothing alternatives.

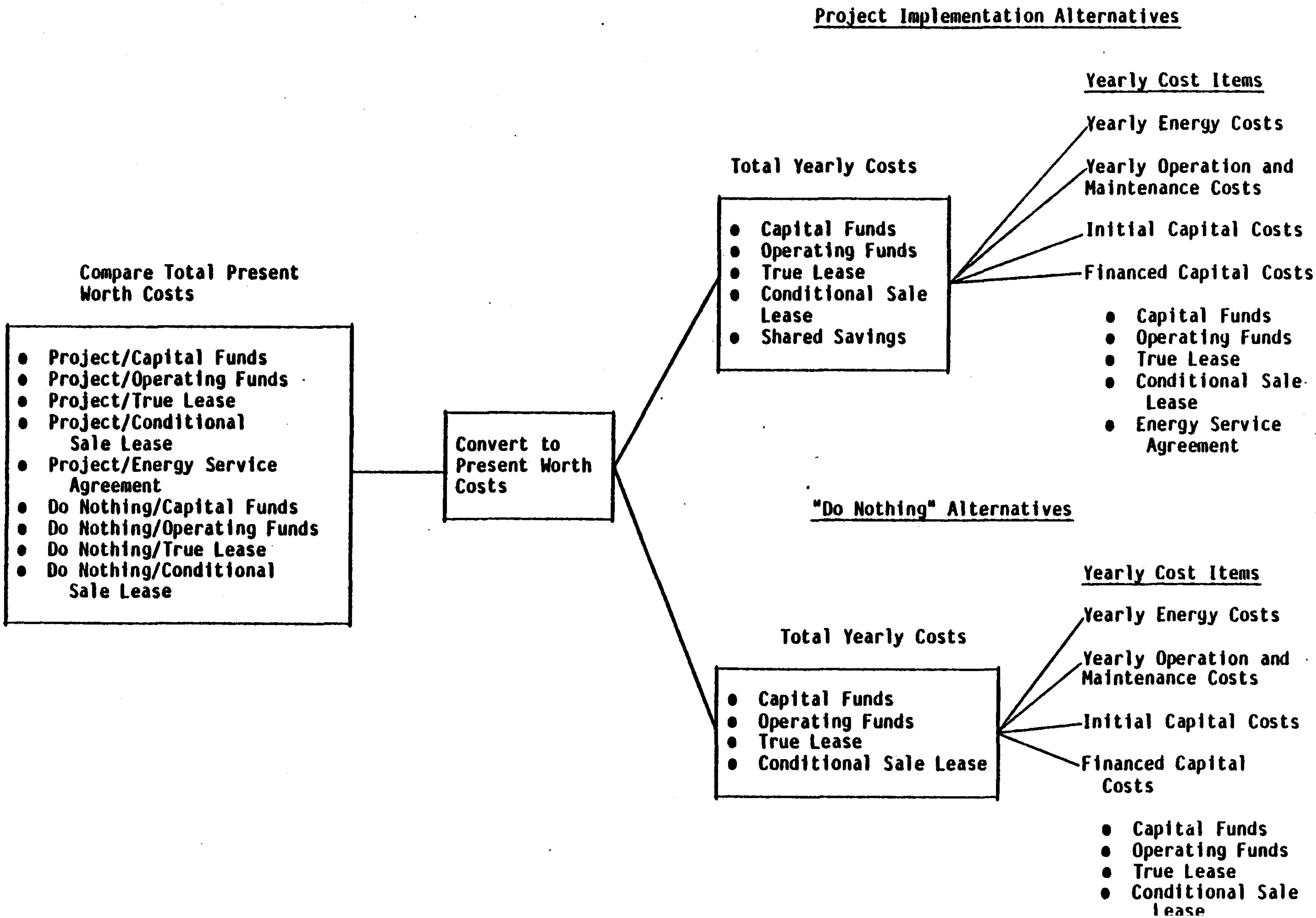
This five step approach, shown in Figure 1, is completed for each of the five financing alternatives. The final report of the model presents the present worth values for the life cycle costs associated with implementing the project using each of the five different financing mechanisms and the present worth values for the life cycle costs associated with not implementing the project, using four different financing alternatives. (The shared savings financing approach is not used for the "do nothing" alternative).

LCC MODEL FEATURES

The Energy LCC approach has a number of capabilities which are described below:

Multiple Projects - The Energy LCC approach allows the user to consider a number of projects of a given type, at the same time by simply indicating the number. The resulting cost analysis will be automatically multiplied by that number to give the total program cost.

Figure 1. Life Cycle Analysis of Energy-Related Projects - Analytical Approach



Private Financing Sources - For those energy projects which may require a combination of local government financing sources, the Energy LCC program can accommodate up to three different financing sources at different interest rates.

Investment Indicators - The Energy LCC program will perform two types of investment analysis - the internal rate of return and the savings investment ratio. The program will perform these functions for each project under consideration.

Energy Cost Escalation Rates - The model uses projected energy costs increases for various fuels used by local government which are periodically issued by the U.S. Department of Energy. The program allows the user to examine and change these rates as necessary.

Local Government Discount Rates - The bond interest rate of the municipality is used to represent the cost of money to the local government so the time value of the money used by the local government can be accounted for accurately.

Tax Benefits To Private Firms - The model estimates the value of the tax benefits available in 1984 to a private company through a leasing contract or "shared savings" arrangement with a local government. These benefits can include either the costs of equipment depreciation or the "interest rate" of the lease. These tax benefits are counted as income to the private company and are assumed to lower net payments that a local government must pay under the contract.

Increases in Parts and Labor Costs - The model allows the user to specify the yearly rate increase for both parts and labor or the model will assume labor cost increases at constant yearly rates over the life of the project.

A primary feature of the Energy Life Cycle Cost model is the "estimated project life". This feature refers to the useful life of the major equipment involved in the project. In some cases, however, the user may want to use a different method of estimating the project life.

Another unique characteristic of the program is its analysis of the cost associated with not implementing a given project. It was found that, in many cases, this option has higher yearly operating costs as well as capital costs impacts later in the project which should be included when considering whether or not to implement a project.

## LCC MODEL ASSUMPTIONS

As in the case with any model, the approaches and assumptions built into the Energy Life Cycle Cost (Energy LCC) model should be checked and understood before the model is deemed useful or even applicable for a local government. The major components of each of these categories are described below.

<u>Yearly Energy Cost</u> - Yearly energy costs consist of electricity costs and fuel costs. Electricity costs, in turn, consist of electricity usage and power costs. The model will account for up to two different fuels used in a project and assumes that the amount of fuel used per year will remain essentially constant over the life of the project.

<u>Operation and Maintenance Costs</u> - Operation and maintenance costs per year for each operation and maintenance function is calculated from the costs provided by the user. The model assumes that the operation and maintenance cost are yearly costs rather than one time costs and it also assumes that the parts and labor costs escalate at constant rates over the life of the project.

<u>Initial Capital Costs</u> - Initial capital costs refer to those components of the capital costs of the project that will be paid outright and not financed. These costs include: down payment or equipment startup costs.

<u>Financed Capital Costs</u> - Financed capital costs vary according to the type of financing mechanisms used. A brief description of the financing mechanisms follows:

o Municipal Bonds - The yearly cost components of municipal bond financing are the payment of principal and interest and the bond marketing costs. Substracted from this amount is the equivalent annual income due to the salvage value of the project equipment at the end of the project life.

o Operating Fund - Operating fund costs are calculated in the same way as municipal bond financing costs except that no bond marketing costs are incurred and additional yearly administrative costs are incurred.

o True Lease Financing - True lease financing costs are the rental payments for equipment from a private company. These costs include the cost of capital, margin of profit, and usually a higher annual cost. The program calculates the annual amounts of deductions, then converts them to present worth values, substracts them from the project cost, and calculates the annual lease payment for the reduced equipment costs.

o Conditional Sale Lease Financing - Conditional sale lease contracts essentially means that the municipality buys the energy equipment on term. The interest portion of the lease payment represents tax free income to the company from which the equipment is purchased. The program calculates the interest portion of the yearly lease payment, multiplies it by the company's tax rate, converts it to a present worth sum, substracts the sum from the equipment costs and recalculates the yearly lease payment.

o Shared Savings Financing - Shared savings arrangements provides that a private company installs, and/or operates and maintains energy saving equipment in return for a share of the resultant energy cost savings. The program assumes that there are financing costs, project management costs, and yearly service and maintenance costs. The financing costs are calculated in the same manner as the financed costs for the true lease or conditional sale lease contracts. The project management costs - marketing, negotiating the contract, equipment installation and shakedown - are incurred at the start of the contract. The yearly service and maintenance costs are costs of equipment maintenance and continued project management cost. The program estimates 10% for project management and 9% for annual service costs as industry norms.

Total Project Cost - The program sums all the individual project costs components to get the total annual project costs for each financing option.

Multiplication by the Present Worth Factor - The present worth factor is a multiplication used to convert future costs to their equivalent present worth values. The present worth factor for each year is calculated by using the municipal bond rate as the interest rate.

Present Worth Total Project Costs - The present worth total project costs are calculated for each year by multiplying the total yearly costs by the present worth factor. The converted yearly costs are then summed to give the total present worth project costs for each financing option.

The Public Technology Incorporated model shows that the adoption of any one of the financing mechanisms would depend to a large degree on the financial characteristics of the local government, the type of energy project being considered, the current federal and state tax laws, and the current cost of borrowing money.

## ANALYSIS OF HOUSTON CASE STUDY

To provide documentation from a life cycle economic approach as to the advantages and disadvantages of using one financing mechanism compared to another, the Energy Life Cycle Cost Program was used to analyze the City of Houston's Case Study. The program model analyzed the economic impact of using: municipal bonds, internal shared savings (energy savings payback fund), true lease, conditional sale lease and shared savings as means of financing the cost of: changing out the lighting, retrofiting the chillers and motor and installation of an energy management system in the City of Houston's City Hall Annex. The Energy LCC computer program, analyzed the economics of implementing the energy projects as compared to not implementing the energy projects. The case study and the results of the analysis are presented in Appendix A. The results of the analysis are summarized in the table below:

HOUSTON CASE STUDY AUGUST 14, 1984
TOTAL COSTS

| FINANCING METHOD | PROJECT TOTAL | IMPLEMENTATION PRESENT WORTH | *** WITHOUT PROJECT *** TOTAL | PRESENT WORTH | *** SAVINGS *** TOTAL | PRESENT WORTH | INT RATE OF RETURN | SAV/INV RATIO |
|---|---|---|---|---|---|---|---|---|
| MUNICIPAL BOND | 554925 | 375075 | 1729925 | 1062236 | 1174999 | 687160 | .4472 | 2,8320 |
| ENERGY SVG. PAYBACK FUND | 554925 | 375075 | 1729925 | 1062236 | 1174999 | 687160 | .4472 | 2,8320 |
| TRUE LEASE | 816053 | 680567 | 1729925 | 1062236 | 913871 | 381669 | .2167 | 1,5608 |
| CONDITIONAL SALE LEASE | 655014 | 546264 | 1729925 | 1062236 | 1074910 | 515972 | .2910 | 1,9445 |
| SHARED SAVINGS | 605017 | 420539 | --- | --- | 1124907 | 641697 | .3964 | 2,5258 |

CONCLUSIONS

The specific energy projects analyzed in the Houston City Hall Annex Case Study are related to the lighting, ventilation, infiltration, air conditioning and heating systems in the facility. The total one-time cost associated with these projects is $340,978.00.

Two important observations can be made:

* The municipal bond financing and the energy savings payback fund methods turned out to be the most economical methods of financing the Houston projects, with leasing as the least feasible, based on life cycle costing.

* It was always more economical to implement the projects rather than "doing nothing".

In light of the cost of "doing nothing" over the cost of "doing something" the City of Houston would be wise to utilize one of the five financing mechanisms analyzed to finance the implementation of the energy projects rather than not implementing the energy projects.

The Energy Life Cycle Cost Model is a simple analytical computer model which can be used to test and compare various alternative financing mechanisms as was done for the Houston Case Study. By utilizing the same assumptions throughout the comparisons it can provide a useful basis for cost comparisons, using life cycle cost approaches. Unfortunately, not all decisions are made based on "total cost" approaches, such as life cycle cost approaches. The following chapter will refine the economical comparisons by incorporating other factors which are important in making a real world decision about financing energy conservation measures.

# CHAPTER 5 -- A COMPARATIVE FRAMEWORK AND SUGGESTIONS FOR APPLICATION

## INTRODUCTION

In Chapter 2, a general review and analysis of fourteen different financing mechanisms was completed, with each financing mechanism discussed separately with respect to its applicability to different types of energy conservation measures. In Chapter 3, seven of the fourteen financing mechanisms were applied in the context of a real world case study - the Houston City Hall Annex. Implications were drawn from workshop presentations regarding the suitability of each of the specified financing tools for the seven energy conservation measures identified. In Chapter 4, a computer program was examined which can be utilized to compare alternative financing techniques based on life cycle cost techniques. That model was used to evaluate the financing techniques recommended for the Houston Case Study from the workshop presentations and to draw a conclusion based on life cycle cost approaches. This chapter will develop a comparative framework which incorporates the analysis done by the workshop presenters and by the Energy Life Cycle Cost Program and adds other factors which exist in the decision-making process - legal implications, political issues, and institutional constraints. It proposes a guide for selecting financing mechanisms based on all the relevant factors, and makes suggestions for the application of the comparative framework.

## COMPARATIVE ANALYSIS

The need for developing a framework to allow comparisons of the various financing mechanisms for energy conservation measures is evident when one considers the previous discussions concerning each financing mechanism. The selection of one mechanism over another will be dependent not only upon the perspective of the financial advisor, the total cost of the project, or even one-time (front-end) cost, but also upon other factors such as the institutional, legal, and political constraints of the local jurisdictions.

The City of Houston developed a guide to lead energy managers through the maze of financing mechanisms researched. A selection process was developed which would give governmental decision makers a sound basis for using one financing mechanism over another. While all fourteen financing tools were investigated and analyzed for purposes of comparison, the City of Houston focused primarily on the following mechanisms: chauffage, economic development, investments/syndications, shared savings, tax-exempt and utility assisted financing mechanisms. A selection process was developed which would give governmental decision makers a sound basis for selecting one financing mechanism over another.

A comparative financing matrix was developed as a result of researching what types of constraints would prohibit the use of any given financing mechanism. From the research and conversations with local and state governmental officials, constraints which were identified were grouped as institutional, legal, and political. Institutional constraints include those actions which are prohibited by the jurisdiction's established customs. Legal constraints are those which prohibit certain actions by established or authorized laws. Political constraints are those which inhibit certain actions by jurisdiction's elected officials.

The matrix shown in Table 2 describes each of the five financing mechanisms identified during this research project. It incorporates the recommendations of the financial advisors who participated in the workshop on the Houston Case Study. It uses the cost analyses developed using PTI's Life Cycle Cost Program. It adds the other constraints which were identified from other users and real world experiences in Houston's own energy conservation efforts. After the project cost ranges have been established, an energy manager can, by using the matrix, quickly see which financing mechanisms are

TABLE 2. MATRIX - FINANCING MECHANISMS SELECTION CRITERIA

| FINANCING CATEGORY | BANK FINANCING | |
|---|---|---|
| TYPE OF FINANCING | 1<br>COMMERCIAL LOANS | 2<br>EXTENDED PAYMENT PLAN |
| MOST APPROPRIATE PROJECT COST | o $20,000 TO $100,000 | o $1,000 TO $1,000,000 |
| ADVANTAGES | o potential savings can be used as collateral<br>o savings repay loan<br>o quick implementation | o savings repay loan<br>o savings guaranteed or insured by vendor |
| DISADVANTAGES | o energy savings measures may not actually reduce cost adequately<br>o inability to repay loan<br>o not normally given on bases of planned energy improvements<br>o collateral value very small<br>o term of loan<br>o high interest rates | o higher interest rates<br>o questions of collateral |
| POLITICAL CONSTRAINTS | o liability of not being able to repay loan | o lack of previous experience |
| LEGAL CONSTRAINTS | o local, state, and federal laws may prohibit using saving to pay loan | o none identified |
| INSTITUTIONAL CONSTRAINTS | o budgetary process<br>o financing market conditions<br>o creditworthiness | o creditworthiness |

1 See Page 9 2 See Page 9

TABLE 2. MATRIX - FINANCING MECHANISMS SELECTION CRITERIA (cont.)

| FINANCING CATEGORY | LOCAL GOVERNMENT FINANCING | | | |
|---|---|---|---|---|
| TYPE OF FINANCING | BONDS (GENERAL OBLIGATION) 3 | OPERATING FUND 4 | REVENUE BONDS 5 | CERTIFICATES OF OBLIGATION 6 |
| MOST APPRORPIATE PROJECT COST | o $100,000 TO $10,000,000 | o $ 50 TO $50,000 | o $100,000 TO $10,000,000 | $100,000 TO $1,000,000 |
| ADVANTAGES | o low interest rates<br>o low insurance cost<br>o savings repay note<br>o long-term projects | o potentially least costly<br>o encourages govt. to stay within budget<br>o strong incentives for conservation<br>o short term projects | o no voter approval<br>o long-term revenue generating projects | o midterm projects(1-5yr)<br>o low cost of issuance<br>o no voter approval<br>o principle and interest paid out of general or revenue funds<br>o savings can be applied to repayment |
| DISADVANTAGES | o voter approval<br>o lengthy and detailed<br>o difficult to organize<br>o difficult to float<br>o fluctuation of interest rates<br>o competes/other funds | o small amount of work-capital<br>o potential overburden of tax payers<br>o competes with other service needs | o competes with other service needs<br>o requires revenue stream | o setting up accounting system<br>o lack of financial accountability<br>o multi-year funding issue |
| POLITICAL CONSTRAINTS | o council/board approval<br>o competes with other service needs | o competes w/other servicee needs<br>o council or board approval required | o adm. approval | o must be approved by council or board<br>o unfamiliarity |
| LEGAL CONSTRAINTS | o approval of Council or board required<br>o local and state laws may prohibit<br>o limitation on amount of bonds issued | o multi-year expenses may be prohibited | o revenue use specified by financing instrument | o local and state laws may prohibit<br>o minimal preparation |
| INSTITUTIONAL CONSTRAINTS | o creditworthiness<br>o budgetary process<br>o lengthy planning procedure and process | o additional adm. cost<br>o budgetary methods and timing | o creditworthiness<br>o lengthy planning procedure & process | o creditworthiness<br>o budgetary process may prevent obligation of funds for payment |

3 See Page 11    4 See Page 11    5 See Page 12    6 See Page 12

TABLE 2. MATRIX - FINANCING MECHANISMS SELECTION CRITERIA (cont.)

| FINANCING CATEGORY | LEASE FINANCING | | |
|---|---|---|---|
| TYPE OF FINANCING | 7<br>TRUE | 8<br>CONDITIONAL SALE LEASE | 9<br>TAX-EXEMPT |
| MOST APPROPRIATE PROJECT COST | o $100,000 TO $1,000,000 | o $10,000 TO 1,000,000 | $ 50,000 TO $12,000,000 |
| ADVANTAGES | o wide range of applcs.<br>o stabilizes cash flow<br>o equity accumulation<br>o reduced risk to stay within budget<br>o access to private funds<br>o lease terms match equipment life<br>o no voter approval<br>o lower maintenance cost | o wide range of applcs.<br>o stablize cash flow<br>o equity accumulation<br>o reduced risk to stay within budget<br>o flexible payments<br>o access to private capital<br>o lease terms match equipment life<br>o energy savings can pay lease payments | o large cost projects<br>o lease/ purchase<br>o no voter approval<br>o no debt incurred<br>o short term obligation<br>o low inter- est rates<br>o flexible<br>o access to private cap<br>o limited range of application |
| DISADVANTAGES | o no equipment ownership<br>o lengthy and detailed<br>o difficult to organize<br>o difficult to float<br>o fluctuation of interest rates<br>o competes/other funds | o responsibility for equipment maint. and insurance<br>o cost may be higher<br>o ownership of equip- ment | o must meet stringent IRS cri- teria<br>o See Conditional Sale Lease |
| POLITICAL CONSTRAINTS | o lack of familiarity<br>o multi-year commit. list | o lack of familiarity<br>o multi-year commitment | o need for support<br>o mutlti-year commitment |
| LEGAL CONSTRAINTS | o lack of familiarity<br>o unfamiliar with benefits | o complex laws<br>o legal limitations | o complex tax laws<br>o legal limi- tations |
| INSTITUTIONAL CONSTRAINTS | o lack of familiarity<br>o economics of equip.<br>o unfamiliar with benefit | o budgetary process<br>o unfamiliar with benefits | o unfamiliar<br>o complex re- quirements |

7 See Page 15 8 See Page 16 9 See Page 17

TABLE 2. MATRIX - FINANCING MECHANISMS SELECTION CRITERIA (cont.)

| FINANCING CATEGORY | SHARED SAVINGS FINANCING | | |
|---|---|---|---|
| TYPE OF FINANCING | CONVENT. SHARED SAVINGS 10 | CHAUFFAGE 11 | SYNDICATION INVESTMENT 12 |
| MOST APPROPIATE PROJECT COST | o $10,000 TO 1,000,000 | o $ 100,00 TO $1,000,000 | $ 500,000 TO $1,000,000 |
| ADVANTAGES | o little or no public initial investment<br>o guaranteed reduction in utility bills<br>o minimized project development & start-up time<br>o purchase option<br>o no fixed payment<br>o ease of implementation<br>o uses private capital<br>o little maintenance | o ease of funding<br>o simple to use<br>o may use private capital<br>o no maintenance | o large projects<br>o prearrangement of energy savings<br>o no risk<br>o bonded indebtedness<br>o uses private capital<br>o no/little maintenance |
| DISADVANTAGES | o discourages investments in other energy savings<br>o no control of building<br>o contractor retention of installed equipment<br>o costly<br>o req. multi-yr contract | o marginal economic impact<br>o inability of any public entity to take advantage of tax benefits<br>o req. multi-year contract | o requires capital intensive projects<br>o 15 year depreciation limit<br>o req. multi-yr contract |
| POLITICAL CONSTRAINTS | o lack of familiarity | o lack of familiarity<br>o no demonstrated success | o owner must leave equip for specific time |
| LEGAL CONSTRAINTS | o lack of familiarity<br>o procurement of services may require competitive bid rather than request for proposals | o none identified | o complex tax laws<br>o statutory limits |
| INSTITUTIONAL CONSTRAINTS | o method of predicting future energy prices and usage<br>o multi-year funding limits | o budgetary proces<br>o multi-year funding limits | o complicated, changing tax rules<br>o multi-year funding limits |

10 See Page 20 11 See Page 21 12 See Page 21

TABLE 2. MATRIX - FINANCING MECHANISMS SELECTION CRITERIA (cont.)

| FINANCING CATEGORY | SUBSIDIZED FINANCING | |
|---|---|---|
| TYPE OF FINANCING | ECONOMIC DEVELOPMENT [13] | UTILITY ASSISTED [14] |
| MOST APPRORPIATE PROJECT COST | o $50,000 TO $1,000,000 | o $100 TO $2,000 |
| ADVANTAGES | o stimulates business investment<br>o creates jobs<br>o leverages private funds | o free energy audits<br>o possible widespread applications<br>o financial resources from investors and rate payers |
| DISADVANTAGES | o competes with other community needs<br>o unfamiliarity for many applications<br>o federal support declining<br>o must be linked to economic development | o requires active support of the utility<br>o requires rate making body approval<br>o limited existing applications |
| POLITICAL CONSTRAINTS | o voter influence<br>o unfamiliarity | o duplication of financing institutions services |
| LEGAL CONSTRAINTS | o requires state enabling legislation | o approval of state regulatory agency |
| INSTITUTIONAL CONSTRAINTS | o lack of flexibility | o public suspicious of utility concern for high energy usage |

13 See Page 25

14 See Page 27

suitable for the cost of any particular project. Once this initial narrowing of the selection of financial mechanisms has been made, the issues of institutional, legal, and political constraints must be resolved. These issues must be addressed on a municipality by municipality basis. However, the matrix provides the energy manager with some basic parameters which might guide the use of one or more of the financing mechanisms.

HOUSTON CASE STUDY CONCLUSIONS

The comparative matrix was used in analyzing the financing mechanisms to be discussed at the workshop on the Houston Case Study. The presenters included in their comments institutional, legal, and political considerations in making their recommendations on the utility of the various financing mechanisms to the seven energy conservation measures identified.

Bank loans, extended payments, operating funds, revenue bond funds, investments, syndications, leasings-true and conditional, and utility assisted types of financing were not suitable based on the project cost. By eliminating these nine financing mechanisms, the remaining six mechanisms were analyzed: shared savings, tax-exempt municipal lease purchase, general obligation bonds, certificates of obligation, chauffage, and economic development.

The economic benefits of using bonds, operating funds, true lease, conditional sale lease and shared savings were analyzed using Public Technology's Energy Life Cycle Cost Program. This program was also used to analyze the economic benefit of not implementing any energy conservation projects in the City Hall Annex.

The LCC program analysis resulted in the recommendation that bond financing and energy savings payback fund methods were the most economical financing mechanisms. The use of an energy savings payback fund (internal shared savings) is being further researched and will be considered as a high priority financing option.

Referring again to the matrix, options based on the institutional, legal, and political constraints in Houston were examined. Because of these influencing factors, it was determined that shared savings or tax-exempt municipal lease purchase would be the best potential mechanisms to finance the City's energy conservation projects. The principal justification for this conclusion was the competition for general obligation bond funds and the relatively low priority established for energy measures in comparison to other needed facilities.

In addition, it was determined that the creation of an internal "shared savings" approach was too difficult to accomplish in a reasonable time frame because of legal, institutional, and political constraints.

The case study, the comparative analysis, the workshop and the use of the Energy Life Cycle Cost program resulted in no quick and easy answers as to the best financing mechanism to use to finance the City's energy projects. However, the data collected provided valuable information on each type of financing mechanism and aided in the decision making process as to which financing mechanisms were most appropriate for our specific needs. A similar process may be applied in most situations.

The City is investigating the shared savings concept in two demonstration library facilities, and it is anticipated that it will be widely applied to major city facilities like the City Hall Annex once the demonstration results are completed and reviewed. The City chose to test the shared savings financing mechanism on a small sized facility and to then decide how and when to use this financing mechanism on its larger facilities.

## LESSONS LEARNED

Conducting this research project seemed to be a reasonable project when it was begun in 1982; however, as time progressed, the magnitude of the project became almost overwhelming. The lessons learned are certainly worth sharing in specific detail with the hope that other municipalities will not repeat some of the same mistakes made in Houston. Some of these lessons learned are:

Selection of objectives was perhaps too broad. Identification of the advantages and disadvantages of the various financing mechanisms and development of a selection process should have been considered as two different projects, although they complement each other. The amount of work required by each was significant. The selection process is not thoroughly tested and may require further refinement.

The energy conservation projects in the Houston Case Study, which were tested as to their applicability for financing mechanisms were not varied enough in costs to serve as a true sample for all fourteen financing mechanisms. Installation cost of the projects in the case study ranged from $5,000 to $117,000 but averaged about $50,000.

The analysis of the economic, institutional, legal, and political constraints is reflective of the constraints identified in the Texas area and more specifically to Houston. However, it appears that many of the constraints that Houston has have been experienced in other jurisdictions. The selection criteria, as developed, must only be used as a tool for starting individual research. The constraints of any financing mechanism will be based on the local laws and state statutes.

The workshop was an excellent spin off of this project because it took a lot of information about financing techniques off the printed pages and put them in a true life situation. This heightened the participants' awareness and interest in financing mechanisms not yet considered to them as viable.

## SUGGESTIONS FOR APPLICATION

Municipal governments have been hard hit in the last decade by increasing prices for all forms of energy. Responding to the need to reduce energy costs by increasing energy use efficiency, many cities and counties have developed sophisticated procedures to measure energy use and cost and to define specifications or captial improvements to reduce or stabilize energy costs. During the middle and late 1970's, these efforts were aided by substantial federal and state government financial and programmatic support. Today, however, this support has eroded to a point where local governments are essentially left with good technical ideas for cost reduction, but financial resources far from adequate for implementation. This decline in revenue sources coupled with a weakened national economy, continuing citizen outcries for tax ceilings and tax relief, and increasing pressure on local budgets just to maintain vital public services, makes conventional financing for municipal energy management improvements appears unlikely to any significant degree.

Efforts to identify viable alternative financing mechanisms do not have a long history. Prior to this research, no municipality has undertaken a project specifically designed to research which mechanisms can or cannot be used to finance municipal energy projects using many of the successful private sector financing tools. The decline in financial resources has; however, created substantial creativity among private sector energy companies. They have attempted to develop viable alternative financing techniques for municipalities, especially for those that require no initial public investment, or those that can be used to leverage a relatively small initial investment into a major cost reduction effort.

In the 1980's a variety of alternative and innovative sources of funds have and will continue to present themselves to the financing of energy improvements. Despite shortages in current revenues and rapid reversals in federal and state grants, local governments will continue to seek out new ways of packaging and financing needed energy projects. So will continue the emergence of new companies offering immediate solutions to financing energy projects.

The variety of financing mechanisms discussed throughout this report not only provides many opportunities, they also illustrate new ways to package energy projects. They raise both broad political and legal questions regarding the desirability of the new techniques and raise concerns that range from the ability of government to assume greater risk to the implication of complicated legal and financial relationships that may develop in the process.

Different energy projects - retrofit of motors, chiller replacement, fleet fuel conversions, heat recovery systems and air conditioning system conversions can be financed in a variety of ways. Aside from traditional financing mechanisms, such as bonds, loans, and operating funds, numerous innovative methods are available to jurisdictions. Traditionally, a major source of capital funds have been the federal government, but cutbacks at that level have forced innovative financing techniques focusing on private sector capital to be adopted by state and local governments - a response by governments to uncertain and varying market demands and changing economic factors. The innovative financing mechanisms include: chauffage, economic development, investments, shared savings, syndications, tax-exempt municipal lease purchase and utility assisted.

Finally, alternative financing arrangements are being entered into in order to solve mutual financing problems. To be successful, both sectors, - private and public - must gain from the arrangement. Such arrangements can combine the most favorable attributes of both business and government; but the legal structure and negotiations needed to put them in play can be complicated and can involve economic, legal, institutional and political risk for both parties.

One of the objectives of this project was to identify various financing mechanisms that were applicable to municipal governments to finance their energy conservation projects. The documentation of the financing mechanisms identified and researched are found in Chapter 2. The energy manager who is interested in getting some or all of the energy projects funded should review this chapter in order to become familiar with the various public sector and private sector financing mechanisms. With this grasp of the basics, the manager should be prepared to apply the various financial mechanisms to specific energy conservation projects and to analyze several constraints associated with the identified mechanisms. The energy manager who is faced with determining the most appropriate financing mechanism to use to finance energy conservation projects can utilize the matrix in this chapter as a guide to use in the selection of specific financing mechanisms based on the parameters of the matrix.

In attempting to effectively compare the financing mechanisms for implementing one or more energy projects, the energy manager needs a method to qualify the major cost items associated with each option in a standardized and acceptable manner. The Energy Life Cycle Costing program developed by PTI shows local government energy managers how to quantitatively assess the economic merits of various financing alternatives for energy conservation projects using a life-cycle cost approach. This analysis serves as another tool to aid energy managers in their decision making process. An explanation of this analysis is in Chapter 4.

The methodology presented in this report is a useful tool that local officials may use to more effectively determine how to finance their energy projects. Applying the economic, legal, institutional, and political selection analysis to the financing concerns of other jurisdictions is dependent on specific characteristics of the local jurisdiction, the type of project being considered, the current federal and state laws, and the current cost of borrowing money. This research has developed a comparative matrix which incorporates all of these relevant factors in the selection process.

While the methodology outlines the important general elements for selecting one financing mechanism over another, specific application and implementation will require detailed analyses that address the financial status of the local jurisdiction.

A--Energy Conservation Measures for City Hall Annex
City of Houston - Case Study

# ENERGY CONSERVATION MEASURES

# FOR

# CITY HALL ANNEX - CITY OF HOUSTON

BY

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Energy costs for City Hall Annex, a 220,000 square foot municipal office building built in 1973 by the City of Houston, has more than doubled from $219,000 in 1979 to an estimated $505,000 in 1983. Energy use has been about the same each year except in 1980 when a cooperative effort by the tenants and the building operators resulted in reducing electrical and natural gas consumption by 10% and 44%, respectively.

This reduction was not sustained because energy conservation was not emphasized in 1981 and because the manually controlled systems often produced conditions that were not acceptable to the tenants. Consumption in 1981 returned to the level of 1979, but the experience in 1980 proved that energy use could be reduced and established a goal for planning for energy conservation projects that would improve the operating characteristics of the building.

The seven projects selected for consideration would have an installation cost of $340,978 and reduce energy costs $163,037 per year for a payback in two years. (A detailed summary of installation costs and savings is shown in Attachment "A" and calculations in Attachment "B"). There would also be a net cash flow over the next ten years of $1,291,022 if utility costs remain the same and $2,598,423 if utility costs continue to increase, but at a rate of 10% each year. If the City of Houston had $339,378 available, investment in these energy conservation projects would certainly be a business-like approach to reducing energy costs. The City does not have the funds available, but the potential savings deserve an extra effort to seek funds from alternative sources.

Sources for the funding of these projects have been classified as follows:

- Tax Exempt Financing
- Economic Development Financing
- Utility Financing
- Syndications & Investments
- Leasing Arrangements
- Shared Savings
- Tax Exempt Leasing

Representatives of the above sources will, during the work session on April 19, 1983, address the projects that would be best suited for their financing. During the summary, the participants will discuss financing the projects jointly as well as individually.

The projects are actually being considered at this time but the City of Houston does not have available funds from bonds or the operating budget. The anticipated savings in electricity, natural gas, and air conditioning can be verified since in every case except in the application of the energy management system, equipment or lamps are to be replaced by items that are guaranteed more efficient and perform the same task without affecting the comfort of the buidling tenants. Electrical and natural gas consumption can be reduced 32.3% and 44.6% by implementing the following energy conservation projects:

Energy Management Systems (EMS)

The Energy Management System will improve the comfort conditions in the building dramatically. The cost of $100,00( will include the installation of a hard-wired EMS, upgrading the present control system, and balancing the air distributior system. Presently, the ten multi-zone air handling units eacł supply five zones or areas that cover half of one floor. Onl} one thermostat is operable for all five zones. The dampers for each of the five zones are being operated manually. The temperatures and air distribution in each zone are unsatisfactory. The EMS will be able to control the temperatures precisely, resulting in comfortable temperatures provided by an efficiently operating air conditioning system. It will also optimize the use of equipment. For example, it will allow outside or fresh air to enter the building only when it is occupied, not during startup prior to the working day. The EMS will start the equipment at the proper time prior to the working day to achieve the desired temperatures in the building by the time the tenants arrive for work. It will also turn lights on and off at the proper times. Automatic control of the building systems will result in a consistently more efficient and comfortable building with low energy use year after year.

The savings of $51,450 for electricity and $9,542 for natural gas were arrived at by using the savings realized in 1980 when lights and air conditioning were controlled manually. The 1980 values were then decreased by 25% to allow conditions that would be more acceptable than those maintained in 1980. These savings are not affected by or dependent upon the other energy conservation measures that are proposed.

Dimmers

The 1,651 fluorescent light fixtures consume approximately 15% of the total power within the building. The dimmers will reduce the voltage input to the ballasts, the light output (or lumens), and the power consumed by 30%. The tenants will not realize this reduction in lighting according to a test conducted by the Office of Energy Conservation in 1980. Reducing the voltage has other positive effects. It will increase the life of the ballasts and fluorescent lamps because they will operate at lower temperatures and will reduce the cooling load by 28.2 tons.

Interior and Exterior Incandescent Can Fixtures Changed to Fluorescent

The 1,010 recessed incandescent can light fixtures are located in corridors or along the exterior perimeter of the building and are for an esthetic effect rather than to satisfy lighting requirements. Replacement of the incandescent lamps with fluorescent lamps will decrease the amount of light slightly and the amount of power consumed by over 80%. Some of these lamps are in use in the basement of City Hall and there have been no complaints. Other benefits are a much longer lamp life and the reduction in cooling load by 27.4 tons where the interior cans are located.

Garage Lighting

Replacing the existing fluorescent light fixtures with 50 high pressure sodium lamps will result in better lighting in the garage and lower energy consumption. These lights operate 24 hours everyday of the year. This makes the net cash flow after the payback of the initial investment very attractive.

Retrofit of Existing Motors with High Efficiency Motors

The new high efficiency motors are from four to eight percent more efficient than the existing motors. The initial investment of $21,958 will result in a net cash flow of $75,998 over a ten year period if energy costs increase by 10% each year.

Replacement of Centrifugal Water Chillers

Westinghouse manufactured the existing water chillers prior to the energy crunch in 1974. The cost of electricity was $.01/KWH as compared to the present $.07/KWH. The existing chillers produce 1.10 tons/KW as compared to the new chillers which produce at 1.34 tons/KW. The existing chillers have been troublesome since their installation and expensive to repair. Westinghouse will no longer manufacture the chillers and parts and repair costs should increase. Note that the new chillers recommended will each have approximately 28 tons less capacity due to the reduced load from the installation of dimmers and change of incandescent cans to fluorescent.

ENERGY CONSERVATION MEASURES FOR CITY HALL ANNEX - CITY OF HOUSTON
Prepared By Phillips S. Baker, P.E.
Deputy Energy Official

Energy Conservation Measures Installation Costs and Savings

| | | | SAVINGS | | | |
|---|---|---|---|---|---|---|
| | | INSTALLATION COSTS | $/YR | PAYBACK-YRS | KWH/MCF YR | A/C TONS |
| 1. | Dimmers | $60,000 | $24,963 | 2.4 | 357,000 | 28.2 |
| 2. | Interior Cans to 22 W Fluor | 16,588 | 24,318 | .68 | 347,400 | 27.4 |
| 3. | Exterior Cans to 22 W Fluor | 5,632 | 6,888 | .81 | 98,400 | -0- |
| 4. | Garage Lighting | 20,000 | 8,891 | 2.25 | 127,020 | -0- |
| 5. | Retrofit - High Efficiency Motors | 21,958 | 6,325 | 3.47 | 90,357 | -0- |
| 6. | Replace Chillers (2-320 tons @ 416 A) | 116,800 | 30,600 | 3.81 | 438,000 | -0- |
| 7. | EMS to Include UpGrade Controls & Balancing System | 100,000 | 51,450 (El)<br>9,542 (NG) | 1.63 | 735,000 (El)<br>1,704 (NG) | |
| | TOTALS | $340,978 | $163,037 | 2.09 | 2,193,176 (El)<br>1,704 (NG) | 55.6 |

Percentage Reductions in Energy

KWH (Elec) = 2,193,176 KWH ÷ 6,800,000 KWH = 32.3%
MCF (NG) = 1704 ÷ 4000 = 42.6%

Assumptions

1. A/C and Interior Lighting Operate 3600 Hrs/Yr
2. Exterior Lights Operate 3000 Hrs/Yr
3. Garage Lights and Fans Operate 8760 Hrs/Yr
4. Present Elec Power Use = 6,800,000 KWH/YR = $476,000/Yr (w/o ECM)
5. Present Natural Gas Use = 4000 MCF/YR = $22,400 (w/o ECM)
6. Water Chillers Operate At Full Load Equivalent To 3000 Hrs

CITY HALL ANNEX

Calculations For Energy Conservation Measures (ECM)

1. DIMMERS TO REDUCE POWER FOR FLUORESCENT LIGHTS TO 70%

Install dimmer systems to reduce on fluorescent lights to 70% of present lighting level. One dimmer as required for each of three legs of the 10-panelboards.

a. Installed Price

Cost = 10 panelboards x 3 dimmers/ea x $2,000 ea

b. Elec Savings

Total KW = 1651 fixtures x 200 w = 330,200 w = 330 kw
KW Savings = 330 KW x 30% (reduction) = 99.1 KW
KWH/Yr = 330 KW x 30% (reduction) x 3600 = 357,000 KWH/Yr
$/Yr = 357,000 x $ .07 = $24,963/Yr

c. Payback

Payback = $60,000 ÷ $24,963 = 2.4 yrs

d. A/C Savings - Instantaneous

A/C Savings = 99.1 KW x 3413 BTU/KW ÷ 12000 tons/BTU =28.2 Tons

2. INTERIOR INCANDESCENT CANS - CHANGE TO FLUORESCENT

Replace existing incandescent lamps with fluorescent lamps

a. Installed Price

Cost = 754 fixtures x $22/Fl Lamp = $16,588

b. Elec Savings

KW = 754 x (150w-22w) = 96,512 w = 96.5 KW
KWH/Yr = 96.5 x 3600 = 347,400 KWH/Yr
$/Yr = 96.5 x $ .07 x 3600 Hrs = $24,318/Yr

c. Payback

Payback = $16,588 ÷ 24,321 = .68 yrs
(Note: This does not include the savings realized from longer life fluorescent lamp)

d. A/C Savings - Instantaneous

A/C Savings = 96.5 KW x 3413 BTU/KW ÷ 12000 Tons/BTU = 27.4 tons

3. EXTERIOR INCANDESCENT CANS - CHANGED TO FLUORESCENT

Replace existing incandescent lamps with fluorescent lamps

a. Installed Price

Cost = 256 fixtures x $22/Fl Lamp = $5632

b. Electric Savings

KW Savings = 256 (150w - 22w) = 32,768 w = 328 KW

KWH/Yr = 32.8 KW x 3000 Hrs/Yr = 98,400 KWH/Yr

$/Yr = 98,400 x .07 = $6888/Yr

c. Payback

Payback = $5632 ÷ $6888 = .82 yrs
(Note: This does not include the savings realized from longer lif fluorescent lamp)

4. GARAGE LIGHTING

Replace existing fluorescent fixtures w/high pressure sodium fixtures

a. Installed Price

Cost = 50 fixtures x $400 = $20,000

b. Elec Savings

KW Savings = (864 lamps x 40) [existing] - (50 x 460) [proposed] = 11,560 w = 11.6 KW

KWH/Yr = 11.6 x 8760 = 101,616 KWH/Yr

$ /Yr = 101,616 x $ .07 = $7113/Yr

c. Payback

Payback = $20,000 ÷ $7113 = 2.81 yrs

5. HIGH EFFICIENCY MOTORS

Replace existing motors w/high efficiency motors.
Information from General Electric

a. Installed Cost

Cost = $21,958

b. Electrical Savings

KWH/Yr = 99,0357

$/Yr = $6325/Yr

c. Payback

Payback = 21,958 ÷ 6325 = 3.47 yrs

6. REPLACE WATER CHILLERS

Replace existing centrifugal water chillers (2-320 tons @ 291 KW - 1.10 tons/KW) with new (2-292 ton @ 218 KW - 1.34 tons/KW)

a. Installed Price

Cost = 2 x 292 x $200 = $116,800

b. Electric Savings

KW = (291 - 218) KW x 2 = 146 KW

KWH/Yr = 146 x 3000 = 438,000 KWH/Yr

$/Yr = 438,000 x .07 = $30,660/Yr

c. Payback

= $116,800 ÷ 30,660 = 3.81 yrs

7. <u>ENERGY MANAGEMENT SYSTEMS (EMS)</u>

Install EMS, upgrade controls, and balance air distribution system

a. Installation Costs

Cost = EMS + controls + balancing

= \$75,000 + \$20,000 + \$5,000

+ \$100,000

b. Electric & Gas Savings

These savings do not include ECM's 1-6 and are calculated using 75% of the experienced reductions while the "Houston Plan" was in effect.

(1982) (1980)
Elec Reduction = 6,880,000 - 5,900,000

= 980,000 KWH/Yr x 75% = 735,000 KWH/Hr

Elec \$ Savings = 735,000 x \$ .07 = \$51,450/Yr

(1982) (1980)
Gas Reduction = 5,144 MCF - 2,872 MCF

= 2,272 MCF x 75% = 1704 MCF/Yr

Gas Savings = 1,704 MCF x \$5.60/MCF = \$9,542/Yr

Total Savings = Elec + Gas

= 51,450 + 9,542

\$/Yr (El & Gas) = \$60,992/Yr

c. Payback

Payback = \$100,000 ÷ \$60,992 = 1.63 yrs

Utility Costs for the City Hall Annex

City of Houston

1979 - 1980 - 1981 - 1982

| | Electricity | | | | | Natural Gas | | |
|---|---|---|---|---|---|---|---|---|
| | KWH | Actual KVA | Billed KVA | Cost | Cost/KWH | MCF | Cost | Cost/MCF |
| Jan 79 | 491,520 | 1,357 | 1,430 | 14,178 | $ .0288 | 1189 | $ 3,578 | $3.01 |
| Feb 79 | 533,760 | 1,373 | 1,430 | 15,693 | .0294 | 1174 | 3,583 | 3.05 |
| Mar 79 | 485,568 | 1,417 | 1,430 | 15,877 | .0327 | 376 | 1,166 | 3.10 |
| Apr 79 | 556,992 | 1,457 | 1,430 | 17,232 | .0309 | 183 | 556 | 3.04 |
| May 79 | 536,640 | 1,516 | 1,430 | 16,899 | .0315 | 106 | 325 | 3.07 |
| Jun 79 | 575,361 | 1,587 | 1,430 | 18,037 | .0314 | 112 | 342 | 3.05 |
| Jul 79 | 589,056 | 1,629 | 1,436 | 19,439 | .0330 | 116 | 353 | 3.04 |
| Aug 79 | 582,528 | 1,631 | 1,468 | 18,758 | .0322 | 113 | 348 | 3.08 |
| Sep 79 | 606,336 | 1,629 | 1,468 | 18,483 | .0305 | 112 | 345 | 3.08 |
| Oct 79 | 591,360 | 1,528 | 1,468 | 17,740 | .0300 | 119 | 366 | 3.08 |
| Nov 79 | 578,496 | 1,541 | 1,468 | 18,372 | .0318 | 173 | 529 | 3.06 |
| Dec 79 | 455,040 | 1,601 | 1,468 | 15,136 | .0333 | 504 | 1,619 | 3.21 |
| | 6,582,657 | 18,266 | 17,356 | $205,844 | $ .0313 | 4,277 | $13,110 | $3.06 |

| | Electricity | | | | | Natural Gas | | |
|---|---|---|---|---|---|---|---|---|
| | KWH | Actual KVA | Billed KVA | Cost | Cost/KWH | MCF | Cost | Cost/MCF |
| Jan 80 | 419,520 | 1,481 | 1,468 | 16,060 | $ .0383 | 476 | 1,572 | $3.30 |
| Feb 80 | 453,120 | 1,398 | 1,430 | 15,671 | .0346 | 550 | 1,880 | 3.42 |
| Mar 80 | 448,320 | 1,337 | 1,468 | 17,672 | .0394 | 200 | 666 | 3.33 |
| Apr 80 | 418,560 | 1,456 | 1,468 | 16,222 | .0388 | 123 | 407 | 3.31 |
| May 80 | 446,784 | 1,480 | 1,468 | 19,082 | .0427 | 108 | 362 | 3.35 |
| Jun 80 | 520,424 | 1,564 | 1,468 | 20,125 | .0387 | 98 | 331 | 3.38 |
| Jul 80 | 522,240 | 1,642 | 1,478 | 20,878 | .0400 | 103 | 347 | 3.37 |
| Aug 80 | 565,440 | 1,645 | 1,481 | 22,651 | .0401 | 100 | 363 | 3.63 |
| Sep 80 | 573,504 | 1,639 | 1,481 | 21,415 | .0373 | 106 | 383 | 3.61 |
| Oct 80 | 537,216 | 1,663 | 1,497 | 19,462 | .0362 | 132 | 470 | 3.56 |
| Nov 80 | 491,520 | 1,599 | 1,497 | 19,107 | .0389 | 338 | 1,265 | 3.74 |
| Dec 80 | 445,632 | 1,311 | 1,497 | 18,645 | .0418 | 538 | 2,068 | 3.84 |
| | 5,932,280 | 18,215 | 17,739 | $226,990 | $ .0383 | 2,872 | $10,114 | $3.52 |

| | Electricity | | | | | Natural Gas | | |
|---|---|---|---|---|---|---|---|---|
| | KWH | Actual KVA | Billed KVA | Cost | Cost/KWH | MCF | Cost | Cost/MCF |
| Jan 81 | 458,520 | 1,358 | 1,497 | 18,921 | $ .0413 | 819 | 3,222 | $3.93 |
| Feb 81 | 457,536 | 1,306 | 1,497 | 19,790 | .0433 | 713 | 2,856 | 4.01 |
| Mar 81 | 433,920 | | 1,497 | 21,103 | .0486 | 312 | 1,248 | 4.00 |
| Apr 81 | 470,400 | | 1,497 | 23,143 | .0492 | 130 | 500 | 3.85 |
| May 81 | 587,520 | | 1,497 | 28,818 | .0491 | 125 | 482 | 3.86 |
| Jun 81 | 643,584 | | 1,497 | 31,179 | .0484 | 131 | 504 | 3.85 |
| Jul 81 | 658,752 | | 1,592 | 34,248 | .0520 | 123 | 475 | 3.86 |
| Aug 81 | 622,790 | 1,635 | 1,497 | 30,329 | .0487 | 112 | 495 | 4.42 |
| Sep 81 | 611,520 | 1,593 | 1,497 | 28,369 | .0464 | 131 | 573 | 4.37 |
| Oct 81 | 560,640 | 1,639 | 1,475 | 27,052 | .0483 | 192 | 852 | 4.44 |
| Nov 81 | 592,704 | 1,577 | 1,475 | 28,831 | .0486 | 234 | 1,056 | 4.51 |
| Dec 81 | 474,816 | 1,313 | 1,475 | 23,687 | .0499 | 577 | 2,755 | 4.77 |
| | 6,572,274 | | 17,993 | $315,470 | $ .0480 | 3,599 | $15,018 | $4.17 |

| | Electricity | | | | | Natural Gas | | |
|---|---|---|---|---|---|---|---|---|
| | KWH | Actual KVA | Billed KVA | Cost | Cost/KWH | MCF | Cost | Cost/MCF |
| Jan 82 | 508,608 | 1,372 | 1,475 | 26,760 | $ .0526 | 1,068 | 5,267 | $4.93 |
| Feb 82 | 500,928 | 1,367 | 1,475 | 24,638 | .0492 | 869 | 4,444 | 5.11 |
| Mar 82 | 495,744 | 1,357 | 1,475 | 30,400 | .0613 | 368 | 1,931 | 5.25 |
| Apr 82 | 551,040 | 1,422 | 1,475 | 33,853 | .0614 | 331 | 1,762 | 5.32 |
| May 82 | 547,200 | 1,350 | 1,475 | 32,351 | .0591 | 134 | 697 | 5.20 |
| Jun 82 | 541,824 | 1,464 | 1,475 | 30,528 | .0563 | 110 | 578 | 5.25 |
| Jul 82 | 679,104 | 1,533 | 1,475 | 40,187 | .0592 | 124 | 647 | 5.21 |
| Aug 82 | 721,536 | 1,366 | 1,475 | 42,116 | .0584 | 106 | 592 | 5.58 |
| Sep 82 | 682,176 | 1,533 | 1,475 | 40,331 | .0591 | 115 | 640 | 5.56 |
| Oct 82 | 602,688 | 1,631 | 1,631 | 35,428 | .0588 | 126 | 698 | 5.54 |
| Nov 82 | 556,032 | 1,561 | 1,561 | 34,945 | .0628 | 248 | 1,401 | 5.65 |
| Dec 82 | 492,480 | 1,464 | 1,468 | 31,163 | .0633 | 339 | 1,884 | 5.56 |
| | 6,879,360 | 17,420 | 17,935 | $402,700 | $ .0585 | 3,938 | $20,541 | $5.22 |

B--Local Government Financing Alternatives For Energy Conservation Projects - Program

# LOCAL GOVERNMENT FINANCING ALTERNATIVES FOR ENERGY CONSERVATION PROJE

Texas Southern University
Ernest Sterling Student Center, Second Floor
TUESDAY-APRIL 19, 1983

## P R O G R A M

| | | |
|---|---|---|
| 8:30 - 9:00 | Registration | |
| | Welcome . . . . . . . . . | .Dr. Leonard H. O. Spearman<br>President, TSU |
| | Moderator . . . . . . . . | .Dewayne Huckabay<br>Asst. Director<br>Finance and Administration |
| 9:00 - 9:15 | Case Study. . . . . . . . | .Phillips S. Baker, P.E.<br>Deputy Energy Official<br>Office of Energy Conservation |
| 9:15 - 10:15 | Public Sector Financing | |
| | o Tax Exempt Financing. . . | .Jim Kerley, Executive V.P.<br>First Southwest Company |
| | o Economic Development Financing . . | .David Hash, Sr. Vice Presiden<br>Baltimore Economic<br>Development Corporation |
| | o Utility Financing . . . | .Robert Michael Mertz<br>Pacific Gas & Electric |
| 10:15 - 10:30 | BREAK | |
| 10:30 - 11:30 | Private Sector Financing | |
| | o Syndications & Investments . . . . . | .Alfred C. Jones, Vice Preside<br>Dean Witter Reynolds, Inc. |
| | o Leasing Arrangements. . . | .George C. Day, Attorney<br>TXL Corporation |
| | o Shared Savings . . . . . | .Arthur Lennon, Vice President<br>Scallop Thermal Management |
| 11:30 - 11:45 | BREAK | |
| 11:45 - 12:30 | Public/Private Financing | |
| | o Tax Exempt Leasing. . . . | .Dick Ronchetti, President<br>First Continental Leasing Corp |
| | o Summary & Discussion | |
| | o Conclusion of Workshop | |

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4. Technical Development Corporation, "Performance Contracting For Energy Efficiency: An Introduction with Case Studies", Albany:New York State Energy Research and Development Authority, 1984.

5. Alliance To Save Energy, "Innovative Financing of Energy Efficiency Projects --Seminar Workbook", Washington, D.C. ASE.

6. Municipal Finance Officers Association, Building Prosperity-Financing Public Infrastructures for Economic Development, Washington, D.C., 1983.

7. Kleeper, Martin, Innovative Financing For Energy Efficiency Improvements, Phase 1 Report, Lane & Edson, P.C., Washington, D.C., 1982.

REPORT AND INFORMATION SOURCE

Additional copies of this report, "Developing Sources and Techniques for Alternative Financing of Energy Conservation Projects for Local Government," and further information on the "Energy Life Cycle Cost Program," are available from:

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For additional information on the conduct of the work described in this report or for other energy conservation efforts sponsored by the City of Houston, please contact:

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